the optics of the microscope to which he directed his energies. So far back as 1898 he published, in collaboration with Mr. Charles Slater, an "Atlas of Bacteriology" containing more than a hundred plates of photomicrographs of bacteria. More recently he brought out his "Photomicrography," and many of his photomicrographs of diatoms are of great excellence. His book on "Microscopy," the third edition of which was published last year, is a general treatise on the construction, optics, and use of the microscope. To the Royal Microscopical Society Mr. Spitta contributed in 1911 a note on Winkel lenses and oculars and a report on the value of some Grayson's rulings, the latter entailing a considerable amount of work, and in 1913 he reported on a collection of lenses and other optical apparatus made by Joseph Jackson Lister, the father of Lord Lister, and presented to the Royal Microscopical Society on the death of the latter.

WE regret to learn of the death of PROF. FRÉDÉRIC HOUSSAY, professor of zoology at the Sorbonne since 1904, and dean of the faculty of science since 1919. Houssay's first piece of work, done under the direction of Lacaze Duthiers, was on the operculum and pedal glands of gastropod molluscs, and he presented this as a thesis for his doctorate in 1884. The same year he left for Persia as a member of the Dieulafoy mission, and returned in 1886. Soon afterwards he began a series of studies in vertebrate embryology, of which perhaps the best known is his contribution to the discussion on the vertebral nature of the skull (1890). After following the development of the skull of axolotl, he supported the view that the skull is segmental and represents ten segments. Houssay next turned to the study of dynamical morphology, and published on this subject two important works, "La forme et la vie" (1900) and "Morphologie dynamique" (1910). He devoted special attention to the functional significance of the form of the body, tail, and fins of fishes, studying the movements in relation to form and stability, and he published the main results in 1912 ("Forme, puissance, et stabilité des poissons"). Almost his last work was a continuation of the same line—a study of the flight of birds and the form of their wings, for which he made detailed measurements of 238 skeletons. We join with our French colleagues in regretting the loss of an ingenious worker and a courteous colleague.

WE regret to announce the death, on January 5, of CAPT. HAROLD STUART FERGUSON, at seventy years of age. Educated at Eton and Wimbledon, Capt. Ferguson passed into Woolwich and obtained a commission in the Royal Artillery, but after a few years' service in that corps he resigned his commission and sailed for India. He eventually became English tutor to the three Princes of Travancore, and when they no longer needed tutelage he was appointed second in command of the Nair Brigade of native troops maintained by H.H. the Maharajah of Travancore From that time until his retirement in 1904 he held various appointments under the Travancore Government, including the directorship of the Trevandrum Museum and Public Gardens, where his great love of animals and birds ensured the very careful management of the wild creatures kept in captivity. His collectors at the same time brought in valuable collections of animals, birds, and plants. While in India he was elected a fellow of the Linnean Society, and on his retirement he interested himself greatly in the Zoological Society's Gardens at Regent's Park, and some time before his death he was elected a member of the council of the society. A man of science, a keen sportsman, and a charming companion, Capt. Ferguson died much regretted by a host of friends.

THE death is announced of PROF. CARL TOLDT, who held the senior chair of anatomy in the University of Vienna for twenty-four years. Prof. Toldt was born in Tirol in 1840, and with him disappears almost the last of the great general anatomists—men who worked at comparative as well as at human anatomy. He was well known for his "Atlas of Anatomy," which appeared in 1896, and soon ran through seven editions. He contributed many papers to anatomical literature, the best known being those which treat of the morphology of the mandible.

Notes.

AT the meeting of the Royal Society on March 3 a discussion on isotopes will be opened by Sir J. J. Thomson.

A WIRELESS Press message from Moscow on January 21 stated that Prince P. Kropotkin had contracted inflammation of the lungs, and a fatal issue was feared. Prince Kropotkin's many friends in this country will be glad to know that a later telegram encourages hope of recovery, and says that his illness is apparently due to bronchitis.

SIR FRANCIS YOUNGHUSBAND, president of the Royal Geographical Society, announced at the meeting of the society on January 24 that the chief of this year's expedition to Mount Everest will be Col. Howard Bury, while the actual reconnaissance of the mountain will be in the charge of Mr. Harold Raeburn, who will leave England for India in March.

THE Galton anniversary meeting will take place on February 16 at the Connaught Rooms, Great Queen Street, Kingsway, London, W.C.2. The Galton lecture will be given by Dr. W. Bateson, at 8.45 p.m., on "Common Sense in Racial Problems," and will be preceded by the Galton dinner, for which tickets may be obtained at the offices of the society, 11 Lincoln's Inn Fields, London, W.C.2

The Department of Scientific and Industrial Research announces that the Research Association for the British Jute Industry has been approved by the Department as complying with the conditions laid down in the Government scheme for the encouragement of industrial research. The secretary of the committee engaged in the establishment of this association is Mr. Frank S. Cathro, 1 Royal Exchange Place, Dundee.

The following lecture arrangements have been made in connection with the Royal College of Physicians of London:– The Milroy lectures (on "Respiratory Efficiency in Relation to Health and Disease") will be delivered by Dr. Martin Flack on February 17, 22, and 24; the Goulstonian lectures (on "Glycæmia and Glycosuria") by Dr. G. Graham on March 1, 3, and 8; and the Lumleian lectures (on "Some Points in the Etiology of Skin Diseases") by Dr. A. Whitfield on March 10, 15, and 17. The lecture-hour in each case will be 5 o'clock.

The physiological laboratory in the central offices of the University of London at South Kensington, of which the director is Prof. A. D. Waller, appears to be in some risk either of extinction or of mutilation by removal to another site. The London County Council, possibly under misapprehension as to the present status of the laboratory, threatens to withdraw the grant hitherto made, while the Senate of the University requires the rooms in July for its clerical staff. If the grant ceases the laboratory is to be closed. If it continues, or funds are provided from another source, the laboratory is to be accommodated elsewhere than on its present site. A letter of protest from Sir E. Sharpey Schafer has been published in the *Times*, and resolutions in favour of maintaining the laboratory in its present situation have been passed by various bodies of physiologists. It would be unfortunate if a valuable centre for research were dismantled in order to find room for work which could so much more easily be done elsewhere.

We trust that an immediate inquiry will be instituted by the Ministry of Agriculture and Fisheries into the alleged effect of the discharge of oil from motor-propelled vessels at sea, to which Sir Arthur Shipley has directed attention in the columns of the *Times*. According to the *Naturalist* for January, gulls, razorbills, and guillemots have recently been picked up along the Yorkshire coast dead or dying, their plumage so saturated with oil that they were unable to fly or dive. Moreover, sedentary forms of rock-pool organisms are dying, and the inshore fisheries suffering in consequence, codling, coalfish, and other species haunting the inshore rocks being very scarce this year. It seems possible that unless remedial measures are taken disaster may overtake our fisheries.

The United States Department of Agriculture has just issued a Circular (No. 135) directing attention to the fact that unless fur-bearing animals are rigidly conserved, the time is not far distant when many of the more valuable species will be exterminated. That this is no alarmist's cry is shown by the fact that both trappers and fur-dealers have urged the Government to take immediate steps to promulgate protection in the form of a close season and the infliction of penalties for furs taken out of condition. It is suggested that State Game Commissions and agricultural experiment stations should promote the raising of fur-bearers such as foxes, skunks, and musk-rats, and that other species less amenable to captivity should be conserved in sanctuaries.

In the Kelvin lecture to the Institution of Electrical Engineers on January 13, Sir William Bragg gave an interesting and luminous account of the way in which the study of the properties of the electron has led to a better understanding of the structure of the atom. His concluding remarks indicate that the improvements he has been able to introduce into his X-ray spectrometer have enabled him to establish the fact that the atoms have different properties in different directions. This supports the theories of Lewis and Langmuir that some of the electrons constituting an atom do not participate in the orbital motion about the nucleus which is characteristic of the electrons of the Rutherford atom, as developed by Bohr and Sommerfeld, but, on the contrary, are restricted to certain portions of the outer surface of the system, in which they describe small closed orbits and so produce magnetic fields which serve as bonds of attachment between atoms.

In co-operation with the Anglo-Batavian Society, the University of London has made arrangements for an interchange of lectures on medical subjects between London and the Netherlands. The first lecture of the series to be given by Dutch professors was delivered by Prof. Wertheim-Salamonson, of Amsterdam, on January 17 at the Royal Society of Medicine, the Vice-Chancellor of the University of London presiding. The subject chosen was "Tonus and Reflexes," one to which the lecturer has devoted much attention. The chief point discussed was the participation in reflexes obtained normally, but especially in some nervous affections, of that remarkable state of shortening into which voluntary muscles can be put by certain conditions—a state in which no electrical changes are to be detected and, as it appears, very little, if any, chemical or thermal changes take place. The lecturer was inclined to attribute the phenomena to effects through the sympathetic supply of muscle. The next lecture will be given by Prof. Boeke, of Leyden, on February 16, the subject being "The Modes of Termination of Nerve-fibres in Muscle."

A discussion, in which a number of kinema experts participated, took place before the Illuminating Engineering Society on January 18 on "The Use and Abuse of Light in Studios for Kinema-film Production." The making of films by artificial light involves the use of illuminations vastly higher than those usual in ordinary lighting, and cases have been mentioned of alleged injury to the eyes of actors arising from exposure to very powerful lights at close quarters. The subject is being considered by the Ministry of Health Committee on the Causes and Prevention of Blindness, the chairman of which, the

Right Hon. G. H. Roberts, made a few remarks at the meeting. Eye-troubles have been attributed to the glare of the intense visible light from certain illuminants, and it has also been suggested that the presence of a high proportion of ultra-violet rays may be an influential factor. It seems evident that the region of the spectrum best suited to film production needs further investigation. Possibly ultra-violet rays of very short wave-length, such as may be liable to affect the eyes, might be excluded without prejudice to photographic effect. The view was expressed by several speakers that the use of very powerful unscreened arcs in studios is rarely necessary, and that the best results are obtained by adopting screening and diffusing devices yielding conditions resembling natural lighting. The Illuminating Engineering Society has prepared a list of queries for circularisation which should yield useful information on these points.

WE have received the following communication from the U.S. National Research Council:—Dr. Henry A. Bumstead, professor of physics and director of the Sloane Physical Laboratory at Yale University, and for the past half-year on leave from the University as chairman of the National Research Council of Washington, D.C., died suddenly on the train on the night of December 31 while returning to Washington from Chicago, where he had been in attendance at the meetings of the American Association for the Advancement of Science and affiliated societies. The following resolution was unanimously adopted at a special meeting of the Interim Committee of the National Research Council held on January 3: "That the National Research Council learns of the death of Dr. Henry A. Bumstead, chairman of the Council, with great sorrow and a profound sense of loss. Dr. Bumstead in his association with the Council had revealed to its officers and members not only a high capacity for administration and a most loyal fidelity to the aims and work of the Council, but also a sweetness of disposition and personal attractiveness which had won for him the devoted and affectionate regard of all his colleagues in the Council. In his death the Council and the scientific world lose a man of most eminent attainments, highest character, and lovable personality. The National Research Council extends to the bereaved wife and family its deepest sympathy and condolence, and wishes to express to them its full appreciation of the great value of the services which Dr. Bumstead rendered it in the period of his association with it and the great loss which it suffers by his untimely death. But may we all remember that 'that life is long that answers life's great ends.'"

PROF. E. WESTERMARCK publishes in *Acta Academiae Aboensis,* part i., an important paper on "The Belief in Spirits in Morocco," the result of several expeditions into that country. It is mainly concerned with an elaborate account of the Jinn or underground spirits which interfere in every phase of human life. Men have been taken to their kingdom or have cohabited with the Jinniya or female spirits. Prof. Westermarck describes in detail the nature and doings of these spirits, prophylactic measures adopted against them, remedies for troubles caused by them, and measures for bringing them under control. He disputes the views of Robertson Smith, who regarded the belief in them to be a survival of totemism; nor can they be regarded originally as the spirits of the dead. Prof. Westermarck regards the conception of the Jinn to be "a generalisation on a much larger scale. These spirits seem to have been invented to explain strange and mysterious phenomena which suggest a volitional cause, especially such as inspire men with fear; but Robertson Smith's theory that their special haunts are places most frequented by wild beasts cannot be accepted. In their present form their original home was Arabia, whence they migrated to Morocco, where the general scheme of belief was mixed up with the local animistic beliefs of the Berber tribes."

THE American Museum of Natural History has arranged for a third Asiatic Expedition in co-operation with the American Asiatic Association and *Asia.* The Chinese Government has been invited to delegate to the expedition men who have had preliminary instruction in various branches of science, so that they may assist and, at the same time, be trained in modern methods of scientific exploration. In return for such help and facilities a duplicate set of the collections will be deposited in Peking to form the basis of a Chinese national museum. To aid this, the American Museum undertakes to train selected Chinese in museum work. It is proposed that the field work shall last for five years. From headquarters in Peking parties will work in the interior of China, Central Asia, Manchuria, and Kamchatka. The zoological collections will help to furnish a hall of Asiatic life in the American Museum of Natural History, where are already the specimens obtained by Mr. R. C. Andrews, the leader of the first and second Asiatic Expeditions. In *Natural History,* the journal of the museum, Mr. Andrews dwells on the fragmentary nature of our knowledge of this region. Some exaggeration is allowed for in propaganda, but when Mr. Andrews says, in italics, "Knowledge of the fossils of Eastern Asia rests almost entirely upon the report on a small collection of teeth and fragmentary bones purchased in the medicine-shops of Tientsin and described by a German named Schlosser," then we recognise that several fragments of knowledge have failed to catch the eye of the writer.

REPORT No. 10 of the Industrial Fatigue Research Board forms a preliminary account of some of the investigations now being undertaken by Messrs. J. Loveday and S. H. Munro into the boot and shoe industry. A historical sketch of the industry is given, and a detailed description of modern processes follows. The daily variations of output of various groups of workers in five factories are then recorded. As in almost all other industries, the Saturday output was found to be low (sometimes only 77 per cent. of the average), but the chief interest of the observations lies in the comparison between the skilled workers with a large output and the relatively unskilled, who showed an output 10 to 50 per cent. smaller. It was found that the former maintained a much more uniform output, and usually they improved slightly from day to day until they reached their acme on Friday. The relatively unskilled workers, on the other hand, showed a more irregular output, which generally fell off after the second or third working day of the week, and sometimes after the first working day. Another section of the report affords striking evidence of the value of rest-pauses. A firm which desired to increase its output without adding new machinery determined to make the experiment of working the double presses with a team of three girls, each operative working forty minutes in each hour and resting twenty minutes, instead of with two girls working continuously throughout the day. In a short time it was found that the total output from the presses had increased 44 per cent., *i.e.* the girls were producing individually nearly as much as they had been able to do previously, but in two-thirds the time.

A COPY has reached us of the first number (January) of the *Journal of Industrial Administration*, the official organ of the Institute of Industrial Administration, which was founded in the spring of last year. The scope of the journal is, it is announced, to be wider than that merely of reporting the proceedings of the institute on the lines usual with professional societies; its editor indicates that his chief aim will be to make the publication "a medium for the pooling of the experience of those interested in the administration of industrial enterprises, so that it may serve the urgent purpose of assisting in the policy of practical education for members." A prominent feature is to be the special section devoted to the discussion by correspondence of the problems connected with industrial administration; the object of this section is to provide members resident in any part of the world with a medium for exchanging views on administrative questions affecting their occupation on an open platform, and in a manner which will, whilst assisting members individually, conduce to the greatest usefulness of the institute. Particulars are given of instructional courses, open to members and non-members, to be held in London; these courses begin on February 2, and deal with production estimating and production costing. The journal contains an abstract of an address on "The Industrial Question" given by Viscount Haldane, O.M., at the inaugural meeting of the institute held on October 23 last. The editorial offices have been established at 110 Victoria Street, S.W.1.

AN important paper by Lord Lovat on recent progress in British forestry appears in the Journal of the Royal Society of Arts for January 7. It begins with a short account of the movement leading to the passing of the Forestry Act in August, 1919, which created the Forestry Commission and empowered this body to expend 3,500,000*l.* in afforestation during the ensuing ten years. Lord Lovat further points out the part which private landowners should play in this great national work, and discusses at some length the relations between forestry and such subjects as hill pasture, land given over to sport, small holdings, and soldier settlements. The paper concludes with an authoritative statement of the operations of the Forestry Commission during its first year. A good beginning has been made; 69,000 acres of land have been acquired and extensive nurseries started, in which there are growing already 129,000,000 seedlings and transplants.

THE burning coal-seams that are a conspicuous feature in the coalfields of the western United States lead G. Sherburne Rogers (U.S. Geol. Surv., Prof. Paper 108–A) to remark that a pile of coal exposed to the direct rays of the sun would be liable to become heated and finally to ignite. From his observations in Montana he concludes that "the physical factors promoting spontaneous combustion are a finely divided condition of the coal, a slight increment of heat from an outside source, and a sufficient volume of coal to retard loss of heat by radiation." The absorption of oxygen by coal when warmed generates further heat, and the process is thus self-accelerating. Parr and Francis are quoted as showing that at 120° C. to 140° C. a critical stage arises, when the occluded oxygen combines with some of the hydrocarbons, producing carbon dioxide and water, accompanied by a rapid rise in temperature. Ignition occurs at 350° C. to 450° C. The fine dust of lignite, it appears, may ignite at 150° C., and of gas-coal at 200° C. The burning of coal-seams in the west is associated with the cuts formed by small and rapid streams. The metamorphic effects of the heat on the overlying rocks have been studied by the author, and include the production of spherulitic glass and of holocrystalline diopside-plagioclase slag.

THE November and December issues for the past year of the Journal of the Franklin Institute contain an important paper on the annealing of glass by Messrs. L. H. Adams and E. D. Williamson, of the geophysical laboratory of the Carnegie Institution of Washington. In order to supply the information demanded by the American glass manufacturers as to the proper method of annealing, the authors have determined the rate of disappearance of an initial stress in glass at any temperature. They find that the reciprocal of the stress increases with the time at a uniform rate which depends on the kind of glass and the temperature at which it is maintained. A table of rates for common glasses at various temperatures is given. As a result of their investigations the authors recommend that glass, and especially optical glass, should be annealed by raising the temperature in about 1½ hours to the value specified in one of the tables as suitable for that glass. This temperature is about 50° C. less than that in common use at the present time. The glass is maintained for four hours at that temperature and then allowed to cool, at first slowly, then rapidly, so that the cooling is over in about three hours, and the whole process lasts only eight hours. This is more effective than the old process, involving greater heating and slow cooling, which lasted twenty hours.

PARTICULARS have reached us of the Elmendorf paper-tester, which indicates the resistance offered by a sample of paper to tearing. A compound pendulum of weight P and equivalent length l is swung always from the same initial angle, and in the course of its downward swing it tears a suitably cut sample of paper held partly by a clamp secured to the pendulum and partly by the fixed support carrying the axis. The pendulum rises on the far side to an angle ϕ_1. When swung without tearing the paper it rises to an angle ϕ_2. The difference in the potential energy of the pendulum at the angles ϕ_1 and ϕ_2 is the work done in tearing the paper, and is equal to $Pl(\cos\phi_1 - \cos\phi_2)$. If the length of tear is d and the tearing resistance to be determined R,

$$R = \frac{Pl}{d}(\cos\phi_1 - \cos\phi_2).$$

In its present form the pendulum has the shape of a segment of a circle pivoted at the centre and calibrated round the circumference. It is held in its initial position by a spring stop. A light pointer mounted frictionally on the axis is set initially against the stop, where it is held until the pendulum commences its return swing; then it moves with the pendulum, and so the extent of the swing is recorded. The calibration can be such that R is read direct. The apparatus can be seen at the office of Messrs. R. J. Marx, 133–39 Finsbury Pavement, E.C.2.

AMONG the announcements of Mr. John Murray is "The Life of Alfred Newton," by A. F. R. Wollaston, in which the many activities of this former professor of zoology in the University of Cambridge will receive attention. The work will also contain a chapter describing Cambridge in the middle of last century, by Sir Arthur E. Shipley, and personal reminiscences of Prof. Newton by Dr. H. Guillemard.

ERRATA.—Dr. T. J. J. See sends the following corrections of values given by him in his letter on the measurement of the angular diameter of Betelgeux printed in last week's issue of NATURE, p. 663:—Lines 16 and 24, "orbit of Venus" should be "orbit of Mars." Lines 33–35 should read: "Sirius, which is itself twenty-fivefold more luminous than our sun. Accordingly, Betelgeux gives about 6500 times the sun's light."

Our Astronomical Column.

PONS-WINNECKE'S COMET.—The reappearance of this periodical comet is expected shortly, and the ensuing perihelion passage is likely to occur at nearly the same time of the year as in 1869, when it was on June 29, and in 1892, when it was June 30. On the former occasion the comet was first seen on April 9, and on the latter March 18. The following is an ephemeris:—

1921	Perihelion June 21 R.A.	Perihelion June 21 Decl. N.	Perihelion June 13 R.A.	Perihelion June 13 Decl. N.
	h. m. s.	° ′	h. m. s.	° ′
Feb. 3	13 26 10	19 8	13 45 16	17 8
11	13 36 11	20 48	13 58 4	18 31
19	13 45 32	22 51	14 11 0	20 17
Mar. 7	14 2 0	28 16	14 37 8	24 59

The date of perihelion passage is a little uncertain, so that for purposes of sweeping two series of positions are given, one on the assumption that it will occur on June 21 and the other on June 13. The comet will probably be rediscovered in February or March, and the meteoric shower connected with it, should it recur, may be expected on the night following June 27.

THE MAGELLANIC CLOUDS.—Dr. E. Hertzsprung has a paper on these clouds in Monthly Notices (vol. lxxx., No. 9). It is based on Mr. R. E. Wilson's measures of the radial velocity of nebulæ (Lick Obs. Pubs., vol. xiii.). On the whole, Mr. Wilson found low velocities for the gaseous nebulæ. There were, however, notable exceptions in the cases of seventeen nebulæ in the greater cloud, which showed average recessions of 276 km./sec., and one in the lesser cloud which showed 168 km./sec. It was a reasonable inference that the clouds were external to our galaxy; indeed, this was already thought probable on other grounds. On studying the individual motions it was seen that they showed a steady upward tendency as one went southward. Mr. Wilson suggested in explanation a rotation of the cloud; Dr. Hertzsprung points out that it is simpler to assume that the variation is a perspective effect, due to different parts of the cloud being at different angular distances from the apex of motion. He applies analysis to the observations, and finds as the most probable solution that the velocity of the greater cloud (corrected for the solar motion) is 608 km./sec. towards R.A. 4h. 31m., S. decl. 4° 42′ (galactic long. 168°, S. lat. 30°). The single nebula observed in the lesser cloud gives a result consistent with the two clouds having the same motion. The greater cloud is 63·7° from the apex, which gives a velocity of 560 km./sec. at right angles to the line of sight. Taking the distance as 10,000 parsecs, this implies an angular velocity of somewhat more than a second per century, the position angle being 348° and 55° for the greater and lesser clouds respectively.

It will be remembered that Dr. Hertzsprung was one of the first to give a trustworthy estimate of the distance of the clouds, based on methods quite similar to those applied later to the globular clusters by Dr. Shapley.

INVESTIGATION OF THE EINSTEIN SPECTRAL SHIFT.—Bulletin No. 64 of Kodaikanal Observatory contains a full account of a second investigation of this effect by Mr. J. Evershed. Mr. Evershed's former result (Bulletin No. 39) indicated considerably more than half the shift predicted by Einstein. In view of Dr. St. John's much smaller result, he planned a more extensive research, using the Anderson 6-in. grating, which was carried out in the spring of 1918. The spectrum of the sun both near the centre and near each pole was compared with the carbon arc. The results are corrected for solar and terrestrial rotation and the earth's radial velocity. The lines used are not the same as those of Dr. St. John, but the strongly marked triple carbon bands extending from 3876·59 to 3881·78. The mean values of the shift, sun *minus* arc, are:

Sun's centre ...	+0·0037 Å.
(omitting one discordant day)	
Sun's north limb ...	+0·0071 Å.
Sun's south limb ...	+0·0100 Å.
Einstein's value ...	+0 0082 Å.

Mr. Evershed notes that the late Mr. Pocock found a similar discordance between the measures at the sun's north and south limbs.